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2011.12

Maison des Sciences Économiques, 106-112 boulevard de L'Hôpital, 75647 Paris Cedex 13
http://centredeconomiesorbonne.univ-paris1.fr/bandeau-haut/documents-de-travail/
ISSN : 1955-611X

How Gender Inequalities Hinder Development: Cross-Country Evidence *

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February 2011

*I thank Catherine Sofer, Eleni Iliopulos and Nicolas Dromel for their very useful advice. I thank the participants at the workshop of development economics at the CES, especially Florent Bresson and Martine Audibert for their comments. I thank the participants at the ISS Workshop and the CSAE conference. Finally, I thank OECD Development Center members and Stefen Klasen for their attention.

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Documents de Travail du Centre d'Economie de la Sorbonne - 2011.12

Abstract

This paper assumes that gender inequality hinders economic and human development: a one standard deviation change in the Gender Inequality Index (GII) will increase long term income per capita by 9.1% and the Human Development Index (HDI) by 4%. Gender inequality may be a explanation of economic development differences : 16% of the long term income difference between South Asia and East Asia & Pacific can be accounted for by the difference in gender inequality. Moreover, this paper provides evidence of a vicious circle between gender inequality and long term income. The multidimensional concept of gender inequality is measured by a composite index with endogenous weightings: the Gender Inequality Index (GII). To correct endogeneity and simultaneity problems, the two-stage and three-stage least square methods are used separately. In this way, the steady state per capita income and the human development levels are estimated for 109 developing countries.

JEL classification: J16, O11, C43

Keywords: Growth, Gender Inequality, Development Economics.

Résumé

Cet article suppose que les inégalités de genre freinent le développement économique et humain : une variation d'un écart-type de l'indicateur d'inégalités de genre (GII) augmente le revenu de long terme par habitant de 9,1% et l'indice de développement humain (IDH) de 4%. Les inégalités de genre peuvent être une explication des différences de développement économique : 16 % de l'écart de revenu entre le sous-continent indien et l'Asie du Sud Est peut être expliqué par la différence en termes d'inégalité de genre. En outre, un cercle vicieux entre inégalités de genre et revenu de long terme est mis en évidence. Le concept multidimensionnel d'inégalité de genre est mesuré par un indicateur composite avec pondérations endogènes (GII). Pour corriger les problèmes d'endogénéité et de simultanéité, les double et triple MCO sont utilisés.

Mots clés : Croissance, inégalité de genre, économie du développement

1 Introduction

In 1998, Liberia had a GDP per capita in PPP (purchasing power parity) of $360, compared to $56,000 in Luxembourg. A massive income gap persists between the developed economies and the least developed countries (LDC). If some economies have converged according to the Solow theory, others continue to sink into poverty. The growth literature has shown that differences in economic growth can be explained by differences in physical and human capital accumulation and technological change. Accumulation and technological change are at best proximate causes of economic growth. But why did some societies manage to accumulate and innovate more rapidly than others?

This paper assumes that market failures explain gender inequality in several dimensions, which creates distortion hindering development. By influencing the way in which human and physical assets are generated, as well as technological progress and the efficiency with which these assets are used in production, gender inequality matters. In excluding half their populations by discrimination, some countries limit their ability to accumulate physical and human capital and to innovate, since gender inequality causes the exclusion of women, even if they are more able than men (Klasen (2002)).

The second contribution of this paper is to provide some evidence of the existence of a vicious circle. A vicious circle entails a complex of events that reinforces itself through a feedback loop toward greater instability, because the negative effect amplifies and feeds the causes which produced it. Certainly, market failures which justify ruling out the "fairer" sex may decrease as a country develops. Thus higher GDP per capita may reduce gender inequality (Dollar & Gatti (1999)). Gender inequality and economic development may be considered as the causes and consequences of each other. After using a 2SLS estimator to determine the impact of gender inequality on long-term per capita income and vice versa, the 3SLS is applied to take into account such a vicious circle.

Here development may be read as economic and human development. Actually economic development is commonly captured by GDP per capita, which is included in the HDI (Human Development Index), a summary measure of human development. It measures the average achievements in a country in three basic dimensions

of human development: a long and healthy life, access to knowledge and a decent standard of living. Given the key role of women in improving education and health,[1] gender inequality can affect negatively school enrolment and life expectancy. Women's situation can therefore affect the overall well-being (WorldBank (2001)).

Another contribution of this paper is to study gender inequality as a multidimensional concept. To the best of my knowledge, evidence only exists on the effect of some dimensions of gender inequality on economic development. The literature focuses on the relationship between gender inequality in education and economic growth (Dollar & Gatti (1999), Knowles & Lorgelly (2002)). Klasen (2002) emphasizes that "low schooling for girls leads to slower growth for all". However, gender inequality appears in several forms that can affect economic and human development. Klasen & Lamanna (2008) have stressed the negative impact of gender inequality in employment on economic development. A growing literature studies gender inequality as a determinant of development, but solely in one dimension at a time. But, these dimensions are substitutable and complementary. So, if in a given country gender inequalities in education are low, while they are high in politics, only a composite indicator can analyse the impact of the global trend of gender inequality on development. In order to reach more definite conclusions on the relationship between gender inequalities and economic performance, a composite index is needed that combines several dimensions of inequalities (Dijkstra (2002)), whenever a plurality of variables is needed for the evaluation of a macroeconomic dimension (Munda & Nardo (2005)). This paper uses the Gender Inequality Index (GII) defined in a previous paper (Ferrant (2010)) to deal with the several dimensions in which gender inequality arises, namely identity, education, health, physical integrity, the political and family spheres, work and access to economic assets.

The paper will proceed as follows: Section 2 briefly presents the Gender Inequalities Index (GII); Section 3 presents the theoretical links between gender inequality and development; Section 4 presents the empirical framework and the data; Section 5 presents the empirical results; and finally, Section 6 concludes.

[1]See for example Thomas (1993), Rosenzweig & Wolpin (1994), Hill & King (1995), Murthi *et al.* (1995), Boone (1996), Thomas & Strauss (1997), Behrman *et al.* (1999), Over (2001).

2 The Gender Inequality Index (GII): Presentation and Construction

2.1 Dimensions and Data

The Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) defines discrimination against women as "any distinction, exclusion or restriction made on the basis of sex which has the effect or purpose of impairing or nullifying the recognition, enjoyment or exercise by women, irrespective of their marital status, on a basis of equality of men and women, of human rights and fundamental freedoms in the political, economic, social, cultural, civil or any other field"[2]. It may be pointed out, as Ferber & Nelson (1993) do, that "gender is the social meaning that is given to biological differences between the sexes, it refers to social constructs rather than to biological givens". Therefore, the GII describes only women's situation relative to men and not the absolute female welfare.

Gender inequality refers to the obvious or hidden disparity between individuals due to gender (WorldBank (2001)). This multidimensional concept contains various aspects which may vary from one country to another depending on the level of development, as well as on social and cultural characteristics, and lastly on institutions. For economic purposes, gender inequality matters because it creates a distortion analogous to a distortionary tax. Indeed, men less able than women have better access to education, political, social and economic resources, to labour markets and therefore to economic opportunities. Thus productivity, capital accumulation, technological progress and the institutional framework of production are affected by all the forms in which gender inequality appears.

Observing that the knowledge of what the relevant dimensions of gender inequality are is limited, the Workshop of the Hague aimed to identify which aspects of gender inequality may hold in different countries, regions and culture.[3] From this point of view, researchers from many different countries[4] and from different disciplines participated in the identification of the main dimensions of gender inequality

[2]Source: UN Division for the Advancement of Women.

[3]The Workshop was held at the Institute of Social Studies in the Hague (January 13-18, 1997).

[4]In particular Dutch, Bhutan, Benin, Costa Rica, the Netherlands, the United Kingdom and Viet Nam.

that can be used in cross-country comparisons and which should be included in a new index (Wieringa (1997)). The eight dimensions retained are considered in the literature as key determinants of economic development. Therefore, these eight dimensions are included in the GII.[5]

First, the Workshop of the Hague considered gender inequality in identity. This dimension describes cultural issues such as the socialization of girls and boys, and the rigidity of the sexual division of roles (Wieringa (1997)). It refers to social behavior conveyed by society and internalized by individuals in the process of socialization, via social norms. Since deviation from social norms is a source of psychological and social sanctions, individuals comply it, in spite of inefficiency. Identity constitutes an economic variable by defining the role of each individual according to his/her gender, his/her economic opportunities and the sexual division of labor (Elster (1989)). The 'gender identity dimension' is measured here with four variables: the female-male ratio of early marriage, the CIRI indicator of women's social rights, gender inequality in terms of freedom of dress and freedom of movement.

Second, the physical integrity dimension received attention. This dimension refers to the absence of violence against women, the control of their sexuality and access to contraception (Wieringa (1997)). This dimension constitutes an economic concern as a determinant of an individual's productivity, which in turn affects economic development (Lucas (1988)). This dimension is described by five variables: the prevalence and acceptance of violence against women, the prevalence of genital mutilation, an indicator of physical security of women, the prevalence of contraception, and adolescent fertility.

Third, the Workshop of the Hague considered gender inequality within the household in terms of the right to divorce, inheritance rights and decision-making (Wieringa (1997)). This dimension can be considered as a key determinant of economic opportunities in the access to social and material resources, as well as economic rights. Moreover gender inequality within families means inequality in bargaining power and therefore in decision-making. It is generally believed that women's decisions within families are more productive than men's (Thomas & Strauss (1997)). Finally, women's decisions encourage education and health, and therefore economic

[5]For more details see Ferrant (2010)

growth (Udry *et al.* (1995)). The following four variables are used to measure this aspect of gender inequalities: the indicator of gender inequality in family law, in parental authority, in inheritance rights and the percentage of households headed by women.

Fourth, political power describes political representation and decision-making (Wieringa (1997)) which are crucial to economic opportunities, rights, power and economic growth, if women are considered as being less-inclined to corruption (Swamy *et al.* (2001)). The traditional indicators of relative female political power are used: the female share of parliamentary seats, the proportion of women legislators, the proportion of women holding ministerial positions and the CIRI indicator of women's political rights.

Fifth, the education dimension retains attention as productivity and human capital accumulation depends on investment in education. This can be considered as a selection distortion effect. A similar distribution of innate abilities between girls and boys is assumed, so that gender inequality in education means that boys less-able than girls have access to education. Thus the average innate ability of those who get educated is lower than it would be without gender discrimination. Therefore, the level of human capital accumulation and its quality are reduced (Klasen (2002)). This dimension is measured by male-female ratio in the literacy rate, in net school enrollment, in primary, secondary and tertiary education and the proportion of women as teachers.

Sixth, the Workshop of the Hague considered gender inequality in access to health. A parallel can be made with the access to education. This dimension is measured by the female-male ratio of life expectancy[6]and Klasen's missing women indicator.[7]

Seventh, access to material resources refers to access to economic resources such as land, housing, and credit. These assets determine the economic role and the pool of possibilities of each gender. Moreover, if one believes that men and women have different and separate productive activities, gender inequality in access to economic

[6]Following Anand & Sen (1995) in the life expectancy component, it is assumed that, given equal treatment and an apparent biological advantage of women, they would outlive men by an average of five years (Johannson (1991)). If female life expectancy exceeds male life expectancy by less or more than five years, a gender gap is held to exist.

[7]This indicator takes into account the two recent controversies surrounding the levels and trends in the number of 'missing women' in the world. See Klasen (2008).

resources means that women's activities are undercapitalized and men's activities are overcapitalized. This leads to the misallocation of these resources. It creates distortions to the extent that the aggregate yield is reduced (Udry (1996)) and technological progress shrinks (von Braun *et al.* (1989)). This dimension includes indicators of gender inequality in terms of access to land, credit and property other than land.

Finally, the employment and income dimension refers to the distribution of paid and unpaid work, wage differentials, formal and informal labor (Wieringa (1997)), the so-called labour dimension. This dimension reflects the economic power of each gender and generates distortion analogous to gender inequalities in education. Indeed, women who are more productive than men are excluded from the labor market. Therefore, the pool of talent from which firms can choose their employees is reduced by gender discrimination, so that the allocation of talent is not optimal (Esteve-Volart (2004)). Furthermore, equal access to work leads to lower fertility rates (Lagerlof (2003)) and reduces the dependency rate. This dimension is measured with the following variables: the CIRI indicator of women's economic rights, the female share in technical, professional, administrative and management positions, the male-female ratio of earned income, of the economic activity rate and the female share in the active population.

2.2 Multiple Correspondences Analysis (MCA) to Determine Weights Endogenously

Correspondence analysis is a descriptive and exploratory technique designed to analyze multi-dimensioned tables containing some measure of correspondence between the rows and columns. These methods were originally developed primarily in France by Jean-Paul Benzécri in the early 1960s and 1970s (see Benzecri (1992)). MCA may be considered to be an extension of simple correspondence analysis to more than two variables. MCA is a correspondence analysis carried out on an indicator matrix with cases as rows and categories of variables as columns. Actually, the inner product of such a matrix is usually analysed, the so-called Burt Table: MCA is a correspondence analysis of the Burt Table. The results provide information which is similar in nature to that produced by factor analysis techniques, and

they allow the structure of categorical variables included in the table to be explored. If Principal Component Analysis (PCA) is adapted for quantitative and continuous variables, MCA is used to analyze qualitative, discrete and ordinal variables. Contrary to PCA, MCA studies the set of relative frequencies of each modality and not their absolute weight. The main advantage of MCA in comparison to PCA is the non-linear analysis between variables (Bazillier & Gouret (2004)).

MCA analyses discrete variables by projecting on different axes the common information contained in these different variables, in order to reduce the number of dimensions minimizing the loss of information, symbolized by the total inertia, which represents the global dispersion of the new scatter (Escofier & Pagès (1998)). The distances between different profiles are calculated thanks to the Khi-2, contrary to other tools of data analysis:

$$d^2(i_1, i_2) = \sum_{j=1}^{n} (\frac{f_{i1j}}{f_{i1}} - \frac{f_{i2j}}{f_{i2}})^2$$

MCA was applied to 32 variables and 8 dimensions,[8] in order to avoid heterogeneity and symmetry problems from PCA (Bazillier & Gouret (2004)). MCA defines endogenously the weight of each dimension in the scalar index (Benzecri (1992)). This scalar index is the first axis which has the highest inertia and will define composite index GII used here . This aggregation method improves the index qualitatively, because MCA minimizes the statistical bias or imperfection of the data.

From a normative point of view, the use of MCA is justified because it does not predefine the economic model, and lets the data speak for itself. Thus, the preexistence of an egalitarian norm is not assumed *a priori*. Instead, the analytical framework is developed to capture gender inequalities. This framework does not define an single model of gender inequalities which is optimal, whatever the level of development or the cultural and religious heritage. However, some configurations may either block or foster economic convergence.

2.3 The GII

Using MCA, the GII was constructed for 109 countries with dimension weights defined endogenously. Weights correspond to their relative contribution to the variance

[8]For more details see Ferrant (2010)

of the aggregate indicator and are computed as the sum of the absolute contribution to the inertia of the first axis for each modality (Escofier & Pagès (1998)). This contribution can be calculated as a linear combination of weights associated with the principal components (Escofier & Pagès (1998)): the relative contribution of a modality to the first axis is equal to the square of its coordinate on this axis divided by the eigenvalue of this axis. For each axis, the sum of the relative contributions of the variables is equal to 100%.

Inequalities related to gender correspond to the deprivation experienced by the women affected. According to Branisa *et al.* (2009), when inequality rises, deprivation expands more than proportionally. Therefore, GII is a non-linear weighted composite indicator which allows only partial compensation.

Our composite index (GII) is defined by the following formula:
$GII = 0.181Family^2 + 0.156Identity^2 + 0.156Health^2 + 0.146EconomicResources^2 + 0.118Education^2 + 0.116PhysicalIntegrity^2 + 0.068Work^2 + 0.06Politic^2$

The GII has four main advantages. First, it includes 8 forms in which gender inequality appears to take into account to the multidimensionality of the concept. Second, MCA minimizes statistical biases and measurement errors. Third, MCA retains only shared characteristics in spite of the presence of disparities. Fourth, each dimension has an endogenous weight according to its discriminating power.

3 The Theoretical Links between Gender Inequality and Development

A vicious circle designates a complex chain of events that reinforces itself through a feedback loop to greater instability, because the negative effect amplifies and feeds the causes which gave birth to it. The term is widely used in economics, in cases where two phenomena interact, to lead to a further deterioration of a situation. A vicious circle also arises when the cause is a consequence of the effect at the same time. This situation is both complicated, dangerous and intractable, as it is hard to cope with.

This paper assumes the presence of a vicious circle, since gender inequality and economic development may be considered as a cause and consequence of each other.

Indeed, if high gender inequality results in low income per capita, which in turn affects negatively the level of gender inequality, the existence of a trap may be assumed.

Moreover, this paper emphasizes the relationship between gender inequality and human development. In this way, development is not only considered in its monetary dimension. Following Anand & Sen (2000) human development includes GDP, education and health as a development aims.

3.1 Gender Inequality and Economic Development: a Vicious Circle

3.1.1 Impact of gender inequality on long-term per capita income

This paper assumes that gender inequality is a constraint on women's economic behaviour, as well as on economic development. According to the WorldBank (2001), "The toll on human lives is a toll on development-since improving the quality of people's lives is development's ultimate goal. But gender inequalities also impose costs on productivity, efficiency, and economic progress. By hindering the accumulation of human capital in the home and the labor market, and by systematically excluding women from access to resources, public services, or productive activities, gender discrimination diminishes an economy's capacity to grow and to raise living standards".

If gender inequality affects women's well being, it may lead to a lower steady state which reduces the well being for all. The growth literature suggests that accumulation of physical and human capital is the main determinant of economic growth. The return on these assets in turn depends on technological progress and on the efficiency of the institutional framework of production. By influencing the way in which these assets are generated, as well as the technological progress and the efficiency with which these assets are used in the production, gender inequality matters.

Gender discrimination refers to the treatment taken toward or against an individual in consideration based solely on gender. It involves excluding or restricting members of one gender from opportunities that are available to others. According to the WorldBank (2001), discriminatory behavior takes many forms, but they all

involve some form of exclusion or rejection. Thus gender inequalities are supposed to have common effects on income per capita, whatever the form in which they appear. An overall trend of gender inequalities is to exclude half of the population from economic opportunities, by restricting their civil liberties through restrictive norms, by reducing their productivity through damage to their physical integrity or limited access to health, by decreasing their human and physical capital accumulation via limited access to education and economic assets respectively, by restraining their bargaining power in the household, and by limiting their political and economic power.

This paper assumes that the effect of gender inequality is a distortionary effect. In ruling out half the population by discrimination, some countries limit their ability to accumulate physical and human capital and to innovate, since gender inequality means exclusion of women, even if they are more able than men. Thus, productivity, as well as investment in human and physical capital are lower than they would be without gender discrimination. The latter leads to the misallocation of resources which affects growth. Moreover, it reduces the efficiency with which assets are being used to produce incomes.

Concerning civil liberties - access to education, health and physical integrity - they are supposed to have a positive impact on the human capital accumulation and the productivity. Social norms are a determining factor in investment in education, health and physical integrity (Elster (1989)). They in turn influence the investment in human capital and thus productivity (Lucas (1988)). If we assume the same distribution in abilities, inequality means that men less able than women have access to the determinant of human capital accumulation and productivity, which leads to a lower level and quality of human capital accumulation (Klasen (2002), Dollar & Gatti (1999)).

Concerning access to economic resources - family, political and economic power - the distortionary effect is the same. If we consider that women in developing countries carry out different activities, inequalities mean less physical accumulation for female activities, which leads to a lower quality capital stock and lower productivity (Udry (1996),Braun1989).

3.1.2 The expected impact of economic development on gender inequality

If gender inequality in its various forms may hinder economic development by reducing the level of income per capita, the latter may influence the extent of gender discrimination (Dollar & Gatti (1999)). A growing literature has examined the relationship between gender inequalities and economic performance since the 1970s. As this paper shows below, this topic has two aspects: the impact of development on gender inequalities and vice versa. Most current work on the first aspect reflects three schools of thought (Forsythe *et al.* (2000)). First, the modernization-neoclassical approach shows that economic development leads to the diminution of gender inequality (Becker (1985), Oneill & Polachek (1993)). The World Bank supports this view: "economic growth has proved a slow instrument of change in the status of women" (Bank (1995) p.44). This approach considers that gender inequalities in human capital result mainly in some other forms of gender inequality but decrease over time (Forsythe *et al.* (2000)). Yet, this discrimination has a cost which creates incentives for decreasing discrimination, namely through a development process. Second, the approach followed by Boserup (1970) finds a U-shaped relationship between gender equality and economic growth. In this view, the initial stages of development lead to a growing gap between men and women, while over the long run, the direction of the correlation reverses (Forsythe *et al.* (2000)). Boserup (1970) assumes the development process has a specialization effect in the gender division of labor. Thus, discrimination is embedded in institutional arrangements, formating the labor market organization and property rules. Then, a similar logic as the neoclassical one may occur. Finally, feminist studies consider that economic growth increases the vulnerability of women (Marchand & Parpart (1995)).

This literature relies on social observations which suggest that the status of women and overall socio-economic development tend to go hand-in-hand (Martineau (1837)). According to Dollar & Gatti (1999) "good times are good for women" since in the poorest countries, women are particularly discriminated against in terms of education, health, or legal rights compared to the richest countries. Gender inequality is a socio-cultural phenomenon which leads to regarding women as the 'weaker' sex. Thus, for a low level of economic development where opportunities are

constrained, discrimination against women is frequent. With economic development, the constraints on opportunities are reduced and inequalities too. This assumption means that market failure leading to gender inequality may decline as countries develop.

3.2 The Impact of Gender Inequality on Human Development

This section follows the literature about the externalities of women's empowerment, which emphasizes the role of women's empowerment in the improvement of health and education indicators.

Considering health, less gender inequality leads to the reduction of infant mortality and malnutrition. Indeed, an educated mother knows more about health and good practices. Yet, if she has an income and participates in decision processes, the reasons of malnutrition and infant mortality can be avoided: an increase of 10% in female enrollment in primary schools corresponds to a decrease in infant mortality equivalent to 4.1 deaths per 1,000 births; the same increase in enrollment of women at the secondary level results in a decrease of 5.6 deaths per 1,000 births (Hill & King (1995)). Moreover, a decrease in gender inequality improves the health status of the society. For example, Over (2001) investigates the impact of gender inequality in education on the AIDS epidemic and finds a higher rate in cities where inequality is higher. According to Thomas (1993), the level of maternal education influences largely the quality of food and household health. The mother's education level also has an impact on her ability to protect her child against the adversities of life, against changes in prices, for example, which could affect diet.

The same implications can be proved in terms of education. The school achievement of mothers indicates their innate abilities which have a positive influence on those of their children and their subjective importance for schooling. In the United States, each additional year of schooling of the mother before the birth of her child added 1.6 points to the child's achievements in math and reading, 2.1 points in vocabulary and increased the probability of attaining higher education level (Rosenzweig & Wolpin (1994)). This concerns the developing countries too: in India, children whose mothers are better educated study almost two hours more per day

than children of uneducated women (Behrman *et al.* (1999)).

Finally, gender inequalities in employment and incomes reduce the bargaining power of women within the household. However, the greater women's bargaining power, the more productive household spending is, especially in terms of the health and education of future generations (Thomas & Strauss (1997)). As mentioned by Boone (1996), autonomy is a key determinant of the relative status of women.[9] He shows that among the impacts of per capita income, greater autonomy of women also leads to lower infant mortality rates. A one point drop in the index of autonomy from 4 (the lowest degree of autonomy) to 3, is expected to decrease infant mortality by 50%, in countries where income per capita is $500 or less.

4 Empirical Framework and Data

The empirical framework is based on three equations. The first and the second ones describe the vicious circle between gender inequality and economic development, while the third one describes the impact of gender inequality on human development.

4.1 Empirical Specification

First, the empirical strategy is built to estimate the vicious circle between gender inequality and economic development. The Mankiw *et al.* (1992) model augmented by human capital is traditionally used to deal with the determinant of long term per capita income (see for example Murdoch & Sandler (2002)). Since the aim of this paper is to study the impact of gender inequality on growth by means of spillover effects on different production factors, the same estimation strategy is used. Thus, the effect of the multidimensional concept of gender inequality (GII) on long-term per capita income is estimated by the following strategy:

$$ln(y_{98}) = \alpha + \beta_1 ln(s_k) + \beta_2 ln(n_i + g + \delta) + \beta_3 ln(h^*) + \beta_4 ln(gii) + \epsilon_y \qquad (1)$$

[9]Female autonomy is defined as the ability of women to lead their own lives, make decisions and have influence on projects that affect them.

where s_k is the fraction of income invested in physical capital, n_i and g are the growth rates of labor and technology (respectively), while the number of effective units of labor growth at the rate $(n+g)$, δ is the rate of depreciation of human and physical capital,[10] thus $(n_i+g+\delta)$ is the rate of population growth and h^* the level of human capital and ϵ the error term.[11]

To deal with the endogeneity problem, a two-stage least square (2SLS) estimation is used and the GII is instrumented. The instrument has to be a key determinant of gender inequality but have no direct effect on economic development. Dollar & Gatti (1999), Boone (1996) ask if gender inequality reflects different social or cultural preferences about gender roles. Boone (1996) estimates gender inequality measured by an index of women's legal rights from Humana (1992), and finds that religious preference variables are useful in explaining gender inequality. Dollar & Gatti (1999) argue that the religious variables and civil liberties belong in the gender equations but not in the growth equation, so they use them as instruments for gender inequality. For them, to a large degree, gender inequality in education and in other areas can be explained by religious preferences and underlying characteristics of societies, such as the extent of civil liberties. Indeed, if culture is a key determinant of gender inequality, religious affiliation can be a potential instrument. Likewise, as civil liberties reflect characteristics of societies about human rights, they constitute a good proxy for gender inequality change. Following Dollar & Gatti (1999), this paper proposes to test the validity of these instruments.

Moreover, I suggest using the CEDAW ratification date as an instrument for gender inequality. Countries which ratify the CEDAW recognize the relevance of the fight against gender inequality. This ratification leads to a change in government behavior on gender inequalities, which in turns leads to an influence on collective and individual behavior. Early ratification can be considered as a greater attention is given to this issue. Equation 2 estimates the impact of income per capita on gender inequality on the one hand, and identifies the instrumentation strategy for

[10] Mankiw *et al.* (1992) suppose that human and physical capital have the same production function. Thus, human capital can be transformed into physical capital without cost.

[11] Note that all variables are considered in logs.

the GII on the other hand.

$$ln(gii) = \psi + \gamma_1 religion + \gamma_2 cl + \gamma_3 Cedaw + \gamma_4 ln(y_{98}) + \epsilon_{gii} \quad (2)$$

where *religion* is the proportion of people who declare themselves as practicing one religion (Buddhist, Muslim, Hindu, Christian or Jew), *cl* includes five dummies for civil liberties, *Cedaw* includes five dummies for the ratification of the CEDAW.

Finally, the income per capita y_{98} is instrumented by geographical characteristics, namely latitude, and a dummy equal to 1 if the country is landlocked. Thus, in a first step, Equations 1 and 2 are estimated by the 2SLS, one after another.

Then, to deal with the simultaneity problem and the correlation between ϵ_y and ϵ_{gii} the 3SLS (Three Stage Least Square) estimator is used. The system includes Equations 1 and 2. It is a systemic methodology, for which all model parameters are estimated jointly. As its name suggests the 3SLS estimator is computed in three stages. The first two are those of the classical 2SLS, applied to each equation of the system separately. The third step is then essentially the same as the terminal stage of feasible GLS (Generalized Least Squares) estimation of a SUR (Seemingly Unrelated Regression) system (Zellner & Theil (1962)).

Second, the impact of gender inequality on human development is estimated (see Equation 3). Using the instrumental variables described below, the 2SLS strategy is applied.

$$HDI = \kappa + \varphi_1 gii + \varphi_2 X + \epsilon_{hdi} \quad (3)$$

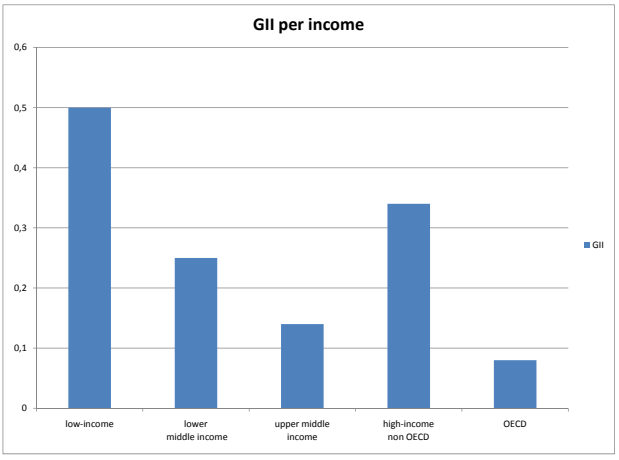
Equation 3 includes four sets of control variables reflecting economic policies which aim to improve human development (Binder & Georgiadis (2010)). First, to consider fiscal policies and incentives to improve the quality and the quantity of education and health supply, government consumption per capita (in logs) is included. Second, the investment (private plus public) rate reflects policy incentives for private sector saving and investment, and government willingness to invest in infrastructure. Third, policy incentives to stimulate international trade are reflected by the logarithm of per capita imports plus exports. Finally, the Rule of law index

captures the government's ability to implement these policies[12].

4.2 Data

The model is estimated for 1998. First, the data used come from the PWT 6.3 (Alan Heston, Robert Summers and Bettina Aten, Penn World Table Version 6.3, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, August 2009.) for GDP per capita in PPP and at constant dollars in 1998, and the average of investment rate for 1970-1998, the average of population rate for 1970-1998. Second, the data used to measure the steady state human capital level is the percentage of the population older than 25 that attained secondary school in 1998 (Barro & Lee (2010)). Third, $g+\delta$ is assumed to be equal to 0.05 (Mankiw *et al.* (1992)). Finally, the Human Development Index (HDI) is a composite statistic used to rank countries by level of human development and it separates developed (high development), developing (middle development), and underdeveloped (low development) countries. The statistic is composed of data on life expectancy, education and GDP per capita. Higher HDI means higher human development levels. The HDI is available on the UNDP website.

Figure 1: GII per income



[12]See Binder *et al.* (2010) for a review of some of the theoretical growth literature discussing the mechanisms through which these control variables may affect the level of human development.

Table 1 presents the mean income per capita and its proximate determinants for the whole sample and by region.[13] Standard deviations are in parentheses, to account for disparities within the sample or sub-sample. All levels of development are considered, as the GDP per capita in 1998 was about $5,723 on average for the whole sample, about $12,692 for MENA countries and about $2,229 for Sub-Saharan Africa. Within regions, high variability may be observed, which means that region is not a good proxy for development levels. Furthermore, disparities in the way to accumulate economic assets are observed. The investment rate varies between 22.40% and 10.57%, according to the region, with an average of 15.75%.

The last row describes the HDI level around the world. The correlation between economic and human development is especially high (0.9274), since the GDP per capita is a component of the HDI. So, parallels can be made in the descriptive statistics. As the HDI varies from 0 to 1, a standard deviation of 0.17 covers a huge range between countries. LAC countries have the highest level of human development, with a mean of 0.76, and are the most homogeneous with a standard deviation of 0.064, while the Sub-Saharan African countries are "the least developed" and the most heterogeneous.

Concerning the instrument for gender inequality in Equation 1, to measure religious affiliation, proportions of persons adhering to each religion are used. For civil liberties, the Freedom House Index is used. The Civil Liberties index measures freedom of expression, assembly, association, and religion. The Freedom House rates civil liberties on a scale of 1 to 7, with 1 representing the most free and 7 representing the least free countries. The CEDAW date of ratification is provided by the UN.[14] The date is transformed into a scale of 1 to 5, with 1 representing the earliest ratification and 5 no ratification.[15] Finally, to instrument the growth rate in Equation 2, a dummy variable equals to 1 if the country is landlocked while latitude given by the CEPII is used.

[13] OECD European countries are used as benchmark

[14] Data available at http://www.un.org/womenwatch/daw/cedaw/states.htm

[15] 1 for ratification before 1986; 2 for ratification before 1990; 3 for ratification before 2000 and 4 for ratification after 2000.

Table 1: Descriptive Statistics by Region

	all	eap	lac	ssa	mena	sa	eca
GDP	5,722.86	6,285.7	7,208.255	2,530.83	12,692.18	2,228.66	5,686.56
	(6854.31)	(8347.76)	(3,650.06)	(2,864.16)	(12,142.38)	(1,187.76)	(3,913.75)
sk	15.75	19	22.4	10.57	14.60	19.66	17.25
	(9.08)	(10.37)	(8.2)	(6.56)	(7.65)	(11.79)	(7.82)
n + g + d	0.7	0.07	0.066	0.077	0.076	0.071	0.051
	(0.1)	(0.06)	(0.007)	(0.016)	(0.119)	(0.0119)	(0.01)
h	27.17	27.15	26.66	20.7	24.55	20.27	60.77
	(18.16)	(17.73)	(11.45)	(17.5)	(11.1)	(13.93)	(8.88)
HDI	0.63	0.68	0.76	0.48	0.73	0.57	0.75
	(0.17)	(0.13)	(0.064)	(0.13)	(0.12)	(0.1)	(0.06)

Standard deviation in parentheses. EAP refers to East Asia and the Pacific, LAC to Latin America and the Caribbean, SSA to Sub-Saharan Africa, MENA to the Middle East and North Africa, SA to South Asia and ECA to Europe and Central Asia.

The descriptive statistics allow a first analysis of gender inequality around the world to be carried out. Table 2 presents the GII score on average for the OECD benchmark, the developing sample, and by region and religion.[16] Disparities in the degree of discrimination occur around the world. The GII score varies between 0.001 (Sweden) and 0.975 (Afghanistan), with an average of 0.28. The standard deviation describes a wide range in the degree of gender inequality, between the countries considered.

Table 2: GII around the world

GII	Obs	Mean of GII	Std. Dev.	Min	Max
All	129	0.28	0.26	0.001	0.975
Developing	109	0.33	0.26	0.004	0.975
OECD	20	0.007	0.007	0.001	0.032
EAP	12	0.17	0.11	0.034	0.392
LAC	21	0.09	0.05	0.027	0.264
SSA	39	0.48	0.21	0.021	0.869
MENA	16	0.48	0.18	0.156	0.886
SA	7	0.63	0.28	0.213	0.975
ECA	14	0.08	0.05	0.004	0.164
Muslim	40	0.5	0.25	0.034	0.975
Hindu	4	0.42	0.33	0.114	0.751
Buddhist	9	0.14	0.08	0.043	0.272
Christian	76	0.18	0.21	0	0.669

EAP refers to East Asia and the Pacific, LAC to Latin America and the Caribbean, SSA to Sub-Saharan Africa, MENA to the Middle East and North Africa, SA to South Asia and ECA to Europe and Central Asia.

Moreover, the level of development (measured by GDP per capita) is highly correlated with the level of gender inequality (correlation coefficient of -0.66). Figure 1 presents GII per income groups.[17] The correlation is confirmed as the higher income group has a lower GII score, except for the MENA countries, which seem to be particular. In Table 2, we can observe a higher mean of GII when we exclude the 20 OECD European countries. As we consider them as more 'developed', the descriptive statistics indicate a negative correlation between the level of development and the level of gender discrimination. But, the exception of the MENA countries means that this assumption must be considered with precaution. Indeed, regional

[16]Here the majority religion is used.

[17]Income group: Economies are divided according to 2008 GNI per capita, calculated using the World Bank Atlas method. The groups are: low income, $975 or less; lower middle income, $976 - $3,855; upper middle income, $3,856 - $11,905; and high income, $11,906 or more. Source: World Bank definition.

and cultural patterns matter.

Table 2 describes a hierarchy between regions and religions in the spread of gender inequality. South Asia (SA) is described as the most unequal region with an average of 0.63, while OECD European countries appear as the most equal. MENA countries and Sub-Saharan Africa follow with a GII score of 0.48 on average. Nevertheless, the extent of the standard deviation seems to suggest strong heterogeneity in Sub-Saharan Africa. Cultural characteristics and especially religion can be considered as an explanation for this variability within African countries. Indeed, Table 2 confirms that religion matters. Hindu and Muslim countries have a score of about 0.4 on average, against 0.2 in Christian countries.

5 Empirical Results

5.1 Economic Development

Table 3: Dependent variable: GDP (2SLS)

	(1) religion	(2) cl	(3) cedaw	(4) cedaw cl	(5) religion cl	(6) religion cedaw cl
lgii	-0.310***	-0.429***	-0.376***	-0.371***	-0.318***	-0.301***
	(3.11)	(3.81)	(3.51)	(3.55)	(3.17)	(3.10)
linv	0.506***	0.424**	0.461***	0.465***	0.501***	0.512***
	(3.12)	(2.52)	(2.79)	(2.83)	(3.08)	(3.17)
lngd	0.183	0.614	0.421	0.401	0.212	0.152
	(0.33)	(1.03)	(0.73)	(0.70)	(0.38)	(0.27)
lls	0.390***	0.355***	0.370***	0.372***	0.388***	0.393***
	(3.27)	(2.91)	(3.08)	(3.10)	(3.25)	(3.30)
Constant	5.693***	6.958***	6.392***	6.333***	5.778***	5.601***
	(3.87)	(4.40)	(4.18)	(4.20)	(3.91)	(3.86)
Observations	109	109	109	109	109	109
R-squared	0.59	0.58	0.58	0.58	0.59	0.59

Absolute value of t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%. Each column indicates the results by instrument variables used: religion refers to the proportion of religious believers, cl to civil liberties and cedaw to the ratification date. All couples are not rejected by the Sargan test. Regional dummies are included.

To analyze the relationship between gender inequality and economic development, the 2SLS and the 3SLS was used. Tables 3 and 4 present the estimation of the impact of gender inequality on long term income and the impact of long term income on gender inequality, respectively. These Tables explore the correlation, while

Table 5 presents the simultaneous estimation of the two impacts and considers the existence of a vicious circle.

Whatever the instrumental variables used (religious believers as a proportion of the population, civil liberties or CEDAW date),[18] the coefficients of GII are negative and highly significant (see Table3). This means that higher gender inequality leads to lower long term income. It confirms that the multidimensional concept of gender inequality hinders economic development. The coefficient takes a high value with a mean of (-0.35) and can be interpreted as an elasticity. To give a quantitative assessment of this result, a one standard deviation change in the log variable of gender inequality (-0.26) will increase the long term income per capita by 9.1% (0.26 x 0.35). Thus, 16% ((0.63 - 0.17) x 0.35) of the long term income difference between South Asia and East Asia & Pacific can be accounted for by the difference in gender inequality.

This effect is sizable when compared to the effect of the other determinants of long term income. Indeed, a one standard deviation change in the log variable of investment and education will increase the income per capita by 28% and 31% respectively.[19] Finally, the control variables have the expected sign: more investment in physical and human capital improves the economic development.

Table 4: Dependent variable GII (2SLS)

	(1) lat landlocked	(2) lat	(3) landlocked
lgdp	-1.203***	-1.426***	-1.799***
	(5.10)	(9.32)	(4.99)
Observations	109	109	109
R-squared	0.57	0.23	0.39

Absolute value of t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%. Each column indicates the results by the instrument variables used: lat refers to the latitude. Couples are not rejected by the Sargan test. Regional dummies are included.

Concerning the impact of long term income on gender inequality, two instrumental variables were used: latitude and a dummy variable equal to 1 if the country

[18]The Sargan test does not reject instrument used here.

[19]If 0.48 and 0.38 are considered as a mean of the estimated coefficient for investment and for education respectively, and 0.61 and 0.82 as the standard deviation of the log variables, then the impact is computed as a mean coefficient x standard deviation.

is landlocked. Table 4 presents the results. The coefficient of GDP is negative and highly significant, meaning that the level of economic development reduces the extent of gender inequality. These result remain in columns (2) and (3), where only one of the two instruments is used. Moreover, the Sargan test does not reject instrument used here. To save space, controls are not be reported in Table 4. Nevertheless, except for the regional dummies, the control variables refer to the GII instruments, namely the proportion of religious believers, civil liberties, and the CEDAW date of ratification, presented in the Annex.

Table 9 in Annex presents the robustness checks. First, the outliers - the MENA countries - are excluded. The results remain: the GII has a negative and significant impact on the long term income and vice-versa. Nevertheless, the magnitude of these coefficients is higher indicating a previous underestimate quantitative assessment. Then, the sample is restricted by including only the more developed countries (HDI > 0.5) and the more equal (GII $>$ median), respectively. The negative relationship between gender inequality and economic development is always highly significant. Finally, in unreported regressions, the GINI coefficient and the percentage of poor people are added as control variables. The results have the same negative sign and are highly significant. This means that even if 60% of poor people are women, the correlation estimated here captures only gender inequality.

The 3SLS results presented in Table 5 confirm the negative impact of gender inequality and economic development on each other. The negative and significant coefficients provide some evidence for the existence of a vicious circle: higher gender inequality leads to lower, long term income per capita, which increases the level of gender inequality and so on.

Compared to the 2SLS results, it may be noted that the magnitude of the GII coefficients (Table 5 column (1)) is reduced. However, the effect remains sizable, as a one standard deviation change in the log variable of gender inequality will increase the long term income per capita by 6.6%, in the first stage of the vicious circle. The other determinant of GDP per capita remains significant. The coefficient of long term income (Table 5 columns (2)) is lower than in the 2SLS results, because simultaneity is applied. These results confirm the existence of a vicious circle between gender inequality and the economic development.

Table 5: 3SLS Results

	(1) Lgdp	(2) Lgii
lgii	**-0.255*** **	
	(2.94)	
Linv	0.404***	
	(3.05)	
Lngd	-0.762*	
	(1.73)	
Lls95	0.320***	
	(3.23)	
Lat90	0.514**	
	(1.96)	
Landlocked	-0.262*	
	(1.88)	
lgdp		**-0.793*** **
		(5.63)
Hindu proportion		0.018***
		(2.85)
Muslim proportion		0.008***
		(3.21)
Civil liberties 2		0.870***
		(2.65)
Cedaw date		-0.008
		(0.68)
Constant	3.723***	3.152**
	(3.13)	(2.09)
Observations	109	109

Absolute value of t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%. 6 dummy variables for civil liberties and regional dummies are included.

5.2 Human Development

This section deals with the estimation of the impact of gender inequality on human development (see Equation 3). Table 6 presents the 2SLS results. The coefficient of GII is negative and significant in all specifications. OLS (see column (1)) and IV estimations confirm the negative impact of gender inequality on human development, whatever the instrumental variables used (see columns (2), (3), (4) and (5)). As in the previous section, the Sargan test does not reject our instruments.

The coefficient has an average of -0.16. In other words, a one standard deviation change in the log variable of gender inequality (-0.26) will increase the HDI by

4.2% (0.26 x 0.16). The importance of these quantitative assessments should not be underestimated, as the HDI ranges from 0 to 1.

Table 6: Human Development estimation

	(1) OLS	(2) religion cl cedaw	(3) religion	(4) cedaw	(5) cl
GII	**-0.297*** **	**-0.172** **	**-0.170** **	**-0.173** **	**-0.134***
	(6.81)	(2.43)	(2.18)	(2.26)	(1.79)
Rule of law	0.068***	0.077***	0.078***	0.077***	0.080***
	(6.01)	(6.22)	(6.10)	(6.11)	(6.26)
Investment	0.085***	0.105***	0.105***	0.105***	0.111***
	(4.60)	(4.98)	(4.85)	(4.86)	(5.08)
Constant	0.425***	0.255*	0.252	0.256*	0.203
	(3.52)	(1.75)	(1.66)	(1.70)	(1.34)
Observations	107	107	107	107	107
R-squared	0.79	0.78	0.78	0.78	0.76

Absolute value of t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%. Each column indicates the results by instrument variables used: religion refers to the religion proportion, cl to civil liberties and cedaw to the ratification date. All couples are not rejected by the Sargan test. Government consumption, trade and regional dummies are included.

6 Conclusion and Implications

There is at present an international consensus which recognizes gender equity as a development goal (WorldBank (2001), Hausmann *et al.* (2007)). The first contribution of this article is to use an aggregated index of gender inequality. Relevant dimensions and reliable data are identified as economic determinants. MCA is used to attribute endogenously a weight for each dimension, according to its discriminating power.

Second, this paper examines the extent to which the multidimensional concept of gender inequality reduces economic and human development. Countries with the same characteristics of investment, human capital, and labor force could have different growth paths, depending on the extent of gender inequality. 2SLS was applied to correct the problem of endogeneity with diverse instruments which appear to be valid and pertinent.

The effect on long term income per capita should not be underestimated, as gender inequality can explain 16% of the difference between South Asia and East Asia & Pacific. Moreover, the relationship between gender inequality and long term

income can be considered as a vicious circle. Indeed, they are the cause and the consequence of each other. This paper finds evidence of a negative effect of income per capita on the extent of gender inequality. Thus, higher gender inequality leads to lower income per capita which in turns reinforces inequality. In these terms, the existence of an "inequality-development trap" may be supposed. Nevertheless, as gender inequality reflects cultural characteristics, change can be made by a positive shock which reverses the direction of the circle. For example the Plague in 1348 was a positive shock for women's empowerment and a cause of reductions in gender inequality (Moor & Zanden (2010)). The Black Death increased women's bargaining power by increasing value in the marriage market. Thus, gender inequality in the family, which is a dimension considered by the GII, was reduced, as was the multi-dimensional concept. A virtuous circle occurs: low gender inequality increases the income per capita which in turn reduces inequality.

Moreover, the negative impact of high gender inequality concerns the non-monetary features of development. A negative correlation with the HDI is provided by the 2SLS results.

Nevertheless, it may be important to end this investigation with some cautionary notes, as we acknowledge the following limitations of this empirical work. First, due to the lack of reliable data the GII is only available for one year. Therefore, it is not possible to obtain a time-series analysis and to control for country-specific effects. Second, although these results seem to be robust, the findings may only show associations but no causality. As it is not possible to control for year -and country- specific effects, it is possible that the findings are partly due to variables omitted.

Finally, some directions for future research can be suggested. Even if it is outside the scope of this paper, a theoretical approach seems necessary to study the existence of an "inequality-development trap" and multi-equilibria. Second, it is necessary to build a time-series index, in order to provide a dynamic dimension to these results, and to take into account country-specific effects.

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Appendix

A First Stage of 2SLS Estimations

Table 7: First stage of long term income estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				lgii			
Hindu proportion	0.018***			0.017***		0.023**	0.024**
	(3.43)			(3.38)		(2.31)	(2.36)
Muslim proportion	0.016***			0.014***		0.012**	0.012**
	(3.09)			(3.82)		(2.97)	(2.89)
Civil liberties 2		1.453***			1.461***	1.360***	1.369***
		(3.27)			(3.30)	(3.22)	(3.24)
Civil liberties 3		2.694***			2.679***	2.534***	2.523***
		(6.14)			(6.14)	(6.05)	(6.02)
Civil liberties 4		3.547***			3.546***	3.198***	3.225***
		(8.19)			(8.21)	(7.51)	(7.57)
Civil liberties 5		3.557***			3.478***	3.060***	3.114***
		(8.47)			(8.15)	(7.07)	(7.15)
Civil liberties 6		3.352***			3.297***	3.137***	3.143***
		(7.33)			(7.17)	(6.71)	(6.65)
Civil liberties 7		4.019***			3.670***	3.237***	3.114***
		(7.36)			(6.42)	(5.63)	(5.30)
Cedaw			1.538***	0.309***	0.676***		0.200***
			(2.66)	(2.55)	(2.50)		(2.45)
Constant	-2.097***	-4.799***	-2.258***	-2.067***	-4.904***	-4.958***	-5.066***
	(3.25)	(12.86)	(12.28)	(3.02)	(12.94)	(6.92)	(7.46)
Sargan test				OK	OK	OK	OK
Observations	109	109	109	109	109	109	109
R-squared	0.30	0.52	0.09	0.31	0.54	0.59	0.60

Absolute value of t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%. Each column indicates the results by the instrument variables used: column (1) includes only the religion proportion, column (2) civil liberties, column (3) cedaw ratification date, column (4) includes religion proportion and cedaw ratification date, column (5) includes civil liberties and cedaw ratification date, column (6) includes religion proportion and civil liberties and column (7) includes all three. All couples are not rejected by the Sargan test.

Table 8: First stage of gender inequality estimation

	(1)	(2)	(3)
		lrgdpl	
Latitude	1.674***		1.686***
	(4.67)		(4.86)
Landlocked		-0.671***	-0.681***
		(2.89)	(3.18)
Constant	8.095***	8.626***	8.272***
	(65.42)	(72.28)	(62.73)
Sargan Test			OK
Observations	129	129	129
R-squared	0.15	0.06	0.21

Absolute value of t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%. Each column indicates the results by the instrument variables used: colum (1) includes only latitude, column (2) the landlocked dummy variable and column (3) includes both. All couples are not rejected by the Sargan test.

B Robustness Checks

Table 9: Robustness Checks

		Long Term Income	Gender Inequality Index
1) Original Sample			
	lgii	-0.301***	
		(3.1)	
	lrgdpl		-1.203***
2) Without MENA countries			(5.1)
	lgii	-0.507***	
		(5.46)	
	lrgdpl		-2.033***
			(5.08)
3) Developed countries (HDI >0.5)			
	lgii	-0.374***	
		(3.69)	
	lrgdpl		-1.306**
			(2.55)
4) More Equal (GII< Median)			
	lgii	-0.614***	
		(5.26)	
	lrgdpl		-1.688**
			(2.22)

Absolute value of t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%. Each column indicates the results by the instrument variables used: colum (1) includes only latitude, column (2) the landlocked dummy variable and column (3) includes both. All couples are not rejected by the Sargan test.